Stability and rheology of silica suspensions stabilised by surface active substances

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Suspensions based on nanosized silica modified by ionogenic and nonionogenic surfactants have been obtained. The dispersion composition, stability and rheological properties have been investigated. Laser diffraction method, scanning electron microscopy and R/S Brookfield rheometer system have been used for the description of the suspensions under study. The influence of different surfactants on the dispersion composition, stability and rheological properties of 25 wh. % OX-50 suspensions has been investigated. The comparison of rheological properties of aerosol suspension stabilized by ethylenglycol as a low molecular weight stabilizer and by polyethylenglycol as a high molecular weight stabilizer showed that the viscosity of suspension is higher for the last one. The more shear rate the higher suspensions' viscosity is observed in both cases. This phenomenon is known as a dilatancy [1]. Modification of suspension by anionogenic surfactant (sodium dodecylsulfate with concentration under critical concentration of micelle formation, CCM) promotes the formation of the stable suspension containing 49 wh. % dispersion phase while modification by nonionogenic surfactant (glycerin monooleate with concentration above CCM) promotes the formation of the stable suspension containing 39 wh. % dispersion phase. As follows from the data of figure the space network of aggregated aerosol particles is formed in the suspension stabilized by glycerin monooleate. In contrast to it the stabilization by sodium dodecylsulphate results in the homogeneous distribution of particles in the volume of suspension. The residue of this suspension has compacted structure after drying. The findings can be applied for developing the technology of synthesis of concentrated stable suspensions used for chemical-mechanical polishing of semiconductor plates [2].

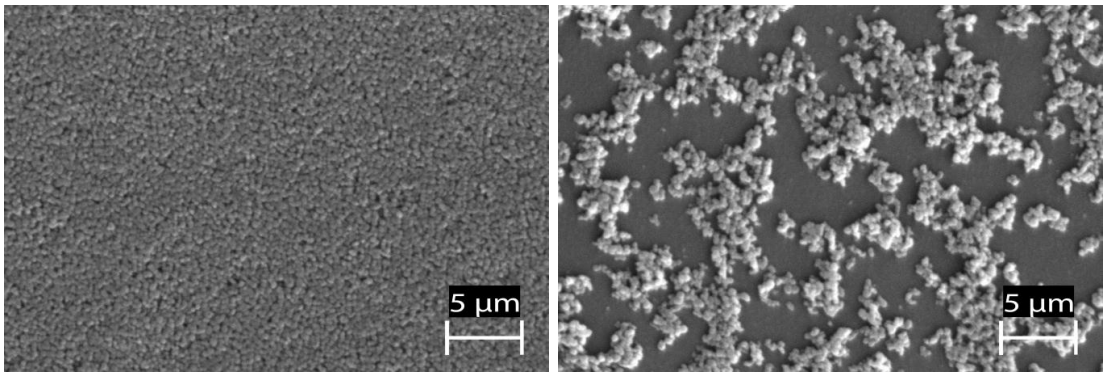

Fig. SEM-image of dried residues of aerosol suspensions:
49.1 ± 0.1 % stabilized by sodium dodecylsulphate (left);
38.7 ± 0.1 % stabilized by monooleate glycerin (right)

References

1. F. J. Galindo-Rosales, F. J. Rubio-Hernández, J. F. Velázquez-Navarro. *Rheologica Acta* (2009) 48.
2. Chemical Mechanical Polishing in Silicon Processing: Semiconductors and semimetals / Ed. By Shin Hwa Li, R.O. Miller. (2000).